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ABSTRACT

To provide curriculum specialists and practitioners with specific information on the source and quality of instructional materials for the metal trades and area and to suggest areas of needed curriculum development, a selected review and analysis of previously processed Educational Resources Information Center (ERIC) documents were made. Recognizing that technological changes have resulted in a demand for programs to train highly skilled and technical workers, this review is addressed to the principal topics of availability of curriculums, availability of guidelines for curriculum development, needed revision is prescribed skills, and needed curriculum development for metal working occupations. The 74 documents included in this study were viewed by first grouping them into the occupational categories of: (1) Machine Trades, (2) Welding, (3) Sheet Metal, (4) Metallurgy, (5) Tool and Die, and (6) Foundry-Casting. Next the documents were grouped and reviewed by their occupational level and their group or educational level. Findings of the study support the conclusion that methodology for curriculum development and prescribed skills seems to be adequate and of high quality for the occupational areas, occupational levels, and group levels. (JS)

Information

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review and analysis of curricula for

OCCUPATIONS IN METALWORKING

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REVIEW AND ANALYSIS OF CURRICULA FOR OCCUPATIONS IN METALWORKING

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ERIC Clearinghouse on Vocational and Technical Education
The Center for Vocational and Technical Education
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PREFACE

This *Review and Analysis of Curricula for Occupations in Metalworking* is one of a series of information analysis papers in vocational and technical education and related fields. It should aid curriculum development specialists and practitioners in assessing the current "state of the art" in the field. The compact nature of the review should be of assistance to practitioners in identifying available curriculum materials to improve operating programs. It should also assist in identifying voids in our present curriculum offerings and enhance future curriculum development efforts, both in terms of their substantive focus and methodological approaches.

All documents in the bibliography are available in microfiche or hard copy from the ERIC Document Reproduction Service (EDRS), unless other information is provided with the citation.

The profession is indebted to Thomas R. Snyder, supervisor of Adult Trade, Extension and Apprenticeship Programs, Department of Adult Education, Columbus Public Schools, Ohio, and Roy L. Butler, acquisition specialist, ERIC Clearinghouse on Vocational and Technical Education, for their scholarship in the preparation of this report. Recognition is also due Byrl Shoemaker, director of Vocational Education, State of Ohio; Charles Dygart, supervisor of Apprenticeship Training and Youth Activities for Trade and Industrial Education, State of Ohio; and Robert M. Reese, chairman of Academic Faculty of Vocational-Technical Education, The Ohio State University. For their critical review of the manuscript prior to its final revision and publication, recognition is due Arthur Jensen, director, Vocational Education Media Center, Clemson University, and Sam Peticolas, Ferris State College, Big Rapids, Michigan. J. David McCracken, information specialist at The Center, coordinated the publication's development.

Members of the profession are invited to offer suggestions for improvement of information analysis papers and to suggest specific topics or problems for future reviews.

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The Center for Vocational and
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and Technical Education

INTRODUCTION

The primary purpose of this information analysis product is to review and analyze curriculum and related materials processed into the ERIC system during the period 1963-69, which focus on training workers in the metalworking trades. The documents included in the review and analysis are representative of selected instructional materials which have been developed primarily by noncommercial sources.

This publication is intended as a secondary, rather than a primary source document. A complete treatment of all curriculum materials developed by all sources is not intended; however, the goal was to cite and review sufficient literature to provide curriculum specialists and practitioners with specific information on the source and quality of instructional materials and suggest areas of needed curriculum development.

Other sources such as the military, commercial publishers, and industry produce materials germane to the subject. Materials from these sources should be reviewed prior to initiating extensive curriculum development for the various areas of metalworking.

Thomas R. Snyder
Roy L. Butler

STATEMENT OF THE TOPIC

There is a growing need for workers in the metalworking trades in the skilled and technical levels due to automation and advanced technological changes. These changes increase the need for service, construction, and manufacturing occupations in the metalworking areas. The outlook for employment in semiskilled and non-skilled areas is becoming increasingly limited; however, highly skilled and creative workers are needed in metalworking industries as the demand for goods and services expands with the population of our country.

The Vocational Education Act of 1963 and the Vocational Education Amendments of 1968 added emphasis for the development of vocational education programs in skilled and technical levels. In addition to the Act and Amendments, the U.S. Department of Labor is working with industry in developing programs for skilled and technical training in metalworking. For example, during 1970-71 the United Auto Workers union will prepare 600 disadvantaged youth for apprenticeship in the metalworking trades in 22 cities in seven states. The U.S. Department of Labor is investing $547,421 in the two-year contract. This marks the first time that an Apprenticeship Outreach program has stepped outside the construction field and focused specifically on the metalworking trades according to an announcement in the July 1970 issue of the *Manpower* magazine.

Vocational educators are always concerned with developing and continual updating of instructional materials. In an effort to be of assistance to this effort, this review and analysis is addressed to the principal topics of: 1) availability of curricula, 2) availability of guidelines for curriculum development, 3) needed revision in prescribed skills, and 4) needed curriculum development for metalworking occupations.

This review and analysis should aid curriculum development specialists and practitioners in assessing, modifying, and developing materials in this area.

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REVIEW AND ANALYSIS OF CURRICULA FOR OCCUPATIONS IN METALWORKING

LITERATURE REVIEWED

The first four volumes of *Research in Education* (RIE)[1], the first 12 issues of *Abstracts of Research and Related Materials in Vocational and Technical Education* (ARM)[2], and the first 11 issues of *Abstracts of Instructional Materials in Vocational and Technical Education* (AIM)[3],were used exclusively to identify relevant documents.

The Search Strategy. A clarification of the topic and a study of *Thesaurus of ERIC Descriptors*[4] yielded the following descriptors for the search:

ELECTRONIC CONTROL
FOUNDRIES
JOB ANALYSIS
MACHINE TOOL OPERATORS
MACHINIST
MATHEMATICAL APPLICATIONS
MEASUREMENT INSTRUMENTS
SHEET METALWORK
SHEET METALWORKERS
SKILL ANALYSIS
TASK ANALYSIS
METALS
METAL INDUSTRY
METALLURGICAL TECHNICIANS
METALLURGY
METALWORKING OCCUPATIONS
NUMERICAL CONTROL
PRACTICAL MATHEMATICS
TASK PERFORMANCE
TOOL AND DIE MAKERS
WELDING
WELDERS

Search and Selection Techniques. The RIE indexes were searched by computer with QUERY[5], while the other indexes were searched manually by the authors. The computer search of *RIE* identified 36 documents and 116 documents were identified from the manual search of AIM and ARM. Specific documents were selected by the authors after examination of the resumes.

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[1] *RIE* is a monthly ERIC publication available from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 for $21.00 a year; foreign $5.25 additional.

[2] *ARM* is a quarterly publication available from the ERIC Clearinghouse on Vocational and Technical Education, The Center for Vocational and Technical Education, The Ohio State University, 1900 Kenny Road, Columbus, Ohio 43210 for $11.00 a year or $9.00 a year for two and three year subscriptions.

[3] *AIM* is a quarterly publication available from the ERIC Clearinghouse on Vocational and Technical Education, The Center for Vocational and Technical Education, The Ohio State University, 1900 Kenny Road, Columbus, Ohio 43210 for $11.00 a year or $9.00 a year for two and three year subscriptions.

[4] *Thesaurus of ERIC Descriptors* is an alphabetized listing of key terms used to describe the contents of documents. These terms provide the subject index for ERIC publications. The *Thesaurus* is available from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402 for $3.25 (Second Edition, OE-12031-69).

[5] *QUERY* is an Assembler language program written for retrieving and disseminating information from diversely formatted files. QUERY enables one to describe any given file structure and to formulate logic for retrieving and extracting information from the file. The search logic adapts itself to specified structuring or segmentation of individual documents in the file.

ANALYSIS OF THE LITERATURE

In the review and analysis of the literature or curriculum for occupations in metalworking, 152 documents were compiled by computer and manual search. Of the 152 documents, the authors determined that 115 documents pertained to the metalworking trades. To facilitate the review and analysis, the authors broke down the metalworking trades into six areas: 1) Machine Trades, 2) Welding, 3) Sheet Metal, 4) Metallurgical, 5) Tool and Die, and 6) Foundry-Casting.

Even though there are other occupations which work with metals, it was felt that these other areas may be included best in other occupational fields for review and analysis.

After reviewing the full text of each document, 74 were chosen by the authors from the 115 related to the topic. The guideline used to determine the 74 documents was the degree of quality and usefulness of the document. At this point no consideration was given to occupational area, occupational level, and group level. The degree of quality and usefulness was based on a scale of 1-5 with 1=poor, 2=fair-poor, 3=fair, 4=good, and 5=excellent. Of the 74 documents, all but four were rated 4 or above. The four documents rated below 4 were kept because they represented the only document found in that particular level.

Availability of Curriculum

Occupational Areas. Out of 74 documents, 35 documents were related to machine trades, 27 were related to welding, seven were related to sheet metal, three were related to metallurgical, two were related to tool and die, and none were related to foundry-casting. In this analysis of the literature or documents representing curriculum in the metalworking occupations there were certain conclusions which seem obvious due to extreme difference in collected data. In this case, the machine trades, welding, and sheet metal trades had an adequate amount of curriculum of proper quality. The sheet metal trade did not have an overabundance of material, but there were seven very good documents.

In the metallurgical occupations, there were three documents. These documents, when rated for quality and usefulness on a 1-5 scale, all rated 3; which means that not only were there very few documents found, but of the documents found the ratings were only fair.

In the tool and die maker occupations, only two documents were found. Of the two located, one covered only the machine section. However, the other was a very well prepared curriculum and guide, but one document is not an adequate number to represent this area.

No documents were found in the area of foundry work.

From these occurrences of documents, the conclusions seem to be that there is a strong need for curriculum, materials, and guidelines in the trade areas of tool and die making, metallurgical, and foundry-casting occupations.

Occupational Level. The 74 documents were also reviewed as to their occupational level. The occupational level was divided into three levels: 1) semiskilled,

2) skilled, and 3) technical. The criteria for determining the occupational level is the relative amount of manipulative and mental skills required of a typical worker in that occuaption.

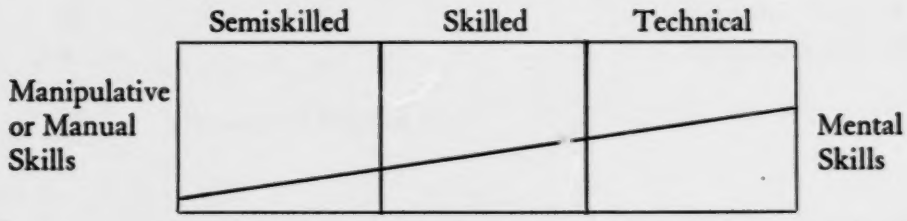

Figure 1

Again there was a high degree of occurrence in one level and very little in the other levels. In the skilled occupational level there were 68 documents, in the technical level there were five documents, and in the semiskilled level there was one document. It seems that curriculum, materials, and/or guidelines for curriculum development in unskilled to semiskilled and technical levels need a large amount of development. This may not be as great in the technical level as in the semiskilled levels because technical materials may not be available for review. This may be due to materials being located in private institutions where materials are not subject to review or included in clearinghouse lists. Also, technical materials are sometimes considered professional in nature and do not make their way to vocational and technical lists.

The semiskilled level is an area which receives little attention. Although the need in this area is decreased due to an increase in technology and automation, there is still a large gap between the need for education and the materials and curriculum available to do the job.

Group Level. Another area in which the analysis concerned itself is the area of group level. For the analysis, group level was divided into four major areas: 1) kindergarten through tenth grade, 2) eleventh grade through twelfth grade, 3) post-secondary, and 4) adult.

The terms post-secondary level and adult level are not universally defined. For clarity in this analysis, post-secondary education is defined as that education less than professional level and yet requiring a higher degree of mental skill than do the skilled trade areas. Post-secondary education usually is considered technical level and earns as associated degree.

Adult education is defined as that phase of education which requires less mental skill development and more manipulative skill development than does the technical level.

Again, in the analysis there are areas of extreme difference in occurrence of related documents. (see Figure 2)

Figure 2

Group Level	*Occurrence*
1. Kindergarten through tenth grade	3
2. Eleventh grade through twelfth grade	37
3. Adult education	30
4. Post-secondary	4
Total Related Documents	74

In the group level kindergarten through tenth grade, there was nothing found that was developed for this level; and there were only three that could be used at this level.

Vocational and technical curriculum for kindergarten through tenth grade level in education is a highly controversial issue. Some educators believe that there should be some sort of pre-skilled, vocational, introductory type education before the student chooses a specific skill or occupational training. Some educators believe that vocational type curriculum should not be introduced before tenth or eleventh grades or even later. However, there is not much doubt that some vocational education will be introduced at this level, and that curriculum material should be developed.

Both eleventh and twelfth grade levels and adult level education had high quality and quantity of documents. In some cases, and to some degree, the curriculum in these two areas can be and is interchanged. There are several reasons for this. One is that different areas of the country are at different stages of vocational education development. One area may not have a good adult education department and have to stress vocational education in the high schools. One school system may have a strong adult education program, and most specific skills are taught in adult education classes.

Caution in interchanging curriculum is used in that even though the same skill level may be desired. The trainees may be at the same training level, the situation and trainee are different and do require different types of curriculum. The adult is employed, generally is more motivated, and needs a more specific type of curriculum than the high school student.

Current Curriculum Development Projects

Occupational Areas. As with availability of curriculum material, curriculum development projects are in progress in the areas of machine trades, welding, and sheet metal; but very little in tool and die and metallurgy; and almost none in foundry-casting.

Occupational Level. Semiskilled and skilled level curriculum are being prepared at state departments of vocational education. Technical level curriculum is being prepared by commercial clearinghouses.

Group Level. Published curriculum is usually done by state departments of vocational education in the levels of kindergarten through tenth grade and

eleventh grade through twelfth grade. In the area of kindergarten through tenth grade, curriculum is being done in the area of students' attitudes and interests, and understanding of vocations in the world of work. There are no plans in the immediate future for the teaching of any metalworking skills in kindergarten through tenth grade.

Curriculum materials are in various stages of being developed in the eleventh through twelfth grade and adult levels in the State Department of Vocational Education.

Post-secondary materials are being developed by commerical clearinghouses.

Methodology for Curriculum Development

In the area of methodology for curriculum development, the materials seem to be of sufficient quantity and quality. They tend to be found in the general teaching materials and not in materials related specifically to the metalworking area.

With the amount and quality of these materials for curriculum development, metalworking curriculums are well prepared in the skills suggested to be taught.

SUMMARY AND IMPLICATIONS

In the review and analysis of the availability of curriculum, certain conclusions seem obvious due to extreme difference in collected data.

From Figure 3 and within the limits of the search, it was concluded that curriculum materials need to be developd for those areas and levels of low occurrence.

Figure 3
Availability of Curriculum

Occupational Area	(Occurrence)	Occupational Level	(Occurrence)	Group Level	(Occurrence)
Machine Trades	35	Semiskilled	1	K through 10	3
Welding	27	Skilled	68	11 through 12	37
Sheet Metal	7	Technical	5	Adult	30
Metallurgical	3			Post-Secondary	4
Tool & Die	2				
Foundry	0				

Methodology for curriculum development and prescribed skills seems to be adequate and of high quality for the occupational areas, occupational level, and group levels in which there were documents available for review. Hence, it would appear that the lack of available documents in certain areas and levels may be due to the low demand rather than lack of methodology for curriculum development.

DESCRIPTION OF THE BIBLIOGRAPHY

The citations in the bibliography were identified by reviewing the ERIC document base, designing a search strategy, and applying search and selection techniques.

Organization of The Bibliography

The bibliography is organized in six sections to permit easier use. Each section is arranged alphabetically by author and title. Description of the content of each section follows.

General—documents in this section cover the general areas of metalworking.

Machine Trades—documents in this section pertain to the operation of metalworking machines.

Metallurgy—documents in this section cover those areas which deal with changing the structure of metals and the skills required to perform such operations.

Sheet Metal—literature in this area covers the skills involved in working with sheet type metals.

Tool and Die—materials in this section include those giving attention to skills required in the construction and service of tooling and die equipment.

Welding—includes information about the general skills, manipulations, and techniques of welding.

Use of The Bibliography

The ERIC system provides indexes and resumes of research and research-related documents in the field of education. Users of this publication are encouraged to utilize the indexes to examine the abstracts of the documents cited in the bibliography. An understanding of the following items will enhance the use of the bibliography.

The Resume. An ERIC resume includes the bibliographic information given in the citations in the bibliography, plus descriptors, identifiers, and an abstract of the document. Each resume is identified with an ED (ERIC Document) number or a VT (Vocational-Technical) number. An ED number identifies material which appears in *Research in Education* (RIE). The resumes appear in ED number sequence in monthly issues of RIE. Documents with VT numbers only are not in RIE, but appear in either *Abstracts of Research and Related Materials in Vocational and Technical Education* (ARM) or *Abstracts of Instructional Materials in Vocational and Technical Education* (AIM). Complete resumes may be examined in AIM and ARM. The abstract portion of the resume usually contains 200 words or less, is written for each document processed into the ERIC system, and may be either informative or descriptive in nature. Informative ab-

stracts summarize content, while descriptive abstracts describe content. In either case, the abstract enables the user to decide upon the appropriateness of acquiring the full text of the document. Descriptors and identifiers, which are located above the abstract in the resume, help to determine the content of individual documents. These terms are listed in the subject index of AIM, ARM and RIE. Quick identification of document abstracts on a particular subject can be accomplished by consulting the subject index. Also, descriptors are primarily used in computerized document retrieval.

Availability of Documents. The resumes cited in the bibliography provide information on the availability of documents processed into the ERIC system. The different availability notations which may appear and a description of each follow.

Microfiche (MF). This is a 4" by 6" flat sheet of film containing photoreproduction of up to 70 document pages. Microfiche can be read only on a microfiche reader. A reader projects the pages on microfiche to full size. If desired, individual full-sized pages may be reproduced from microfiche by using a microfiche reader-printer. Microfiche may be conveniently and economically mailed, stored, and used.

Hard Copy (HC). This is a photocopy reproduced from microfiche. Hard copy is approximately two-thirds of the size of the original document from which the microfiche is filmed.

The full text of most documents announced in ERIC indexes are available either on microfiche only or on both microfiche and hard copy. The price of these different mediums is indicated in the bibliographic citations of the resume.

MF Available in VT-ERIC Set. This indicates that microfiche for the particular VT document is available from a set or group of documents which are filmed in a continuous manner and announced under one ED number. Most documents appearing in the issues of AIM and ARM are available in VT-ERIC sets. The ED number for each issue or package of the AIM and ARM VT-ERIC Microfiche Sets is announced and may be found in a later issue of *Research in Education* (RIE). Also, the ED numbers of the VT-ERIC microfiche sets for previous AIM and ARM document collections may be found in the introductory section of later issues of AIM and ARM.

Document Not Available From EDRS. This means the full text of the document relating to the abstract is not available from the ERIC Document Reproduction Service (EDRS) in any form. The address, and usually the price from which the full text may be ordered will be found in the bibliographic citation of the resume.

Ordering ERIC Microfiche and Hard Copy

ERIC microfiche are available for most individual documents cited in *Research in Education* (RIE). Availability and prices of microfiche are provided on the EDRS price line in the citation. Microfiche are designated as MF and hard copy as HC on this line.

Most documents with only a VT number are available in VT-ERIC microfiche sets. The VT-ERIC set may be ordered only by citing the ED number assigned to the set of documents.

All documents available on microfiche, including the special vocational-technical education microfiche packages (VT-ERIC Set), may be obtained and kept up-to-date by placing a standing order. See page 222 in the December 1969 issue of *Research in Education* (RIE) for complete information. VT-ERIC microfiche sets can be ordered separately, however, substantial price advantages are gained by acquiring the complete ERIC microfiche collection.

The latest ordering and pricing information is provided in the most current issue of *Research in Education*.

An Additional Note on Availability. Interested individuals will find complete ERIC microfiche collections are available for use at many university libraries, state departments of education, and vocational-technical education research coordinating units (RCU). Vocational-technical educators are encouraged to seek assistance from the RCU in their home state.

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Available from—The Center for Vocational and Technical Education, The Ohio State University, 1900 Kenny Road, Columbus, Ohio 43210
ED 035 746
EDRS Price MF-$0.50 HC-$4.20

[1] Bibliographical entries followed by an ED number are generally available in hard copy or microfiche through the Educational Resources Information Center (ERIC). This availability is indicated by the abbreviations, MF for microfiche and HC for hard copy. Order from ERIC Document Reproduction Service (EDRS), The National Cash Register Company, 4936 Fairmont Avenue, Bethesda, Maryland 20014. For all orders, add $0.50 handling charge and sales tax appropriate to the state where the order is originated. Foreign orders must be accompanied by a 25 percent service charge, calculated to the nearest cent. Payment must accompany orders totaling less than $5.00. Items with ED numbers only are available from the publisher.

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MF Available in VT-ERIC Set (ED 020 442)
VT 003 494 (Summer AIM '68)

A Basic Plan for the Organization and Management of Instruction in Vocational Metal Trades.
Mississippi State Univ., State College. Curriculum Lab.
Mississippi State Dept. of Vocational Education, State College.
Pub Date Apr 67
Note—71 p.
MF Available in VT-ERIC Set (ED 020 442)
VT 003 492 (Summer AIM '68)

A Basic Plan for the Organization and Management of Instruction in Vocational Sheet Metal.
Mississippi State Univ., State College. Curriculum Lab.
Mississippi State Dept. of Vocational Education, State College.
Pub Date Mar 67
Note—36 p.
MF Available in VT-ERIC Set (ED 020 442)
VT 003 493 (Summer AIM '68)

Biebesheimer, Howard, and Others
Machine Shop. Part 1, Workbook.
California State Dept. of Education, Sacramento. Bur. of Ind. Educ.
Pub Date 64
Note—166 p.
MF Available in VT-ERIC Set (ED 022 971)
VT 005 181 (Fall AIM '68)

Blueprint Reading for Metal Trades.
Metal Trades Advisory Committee, Bedford, Ind.
Indiana State Univ., Terre Haute, Instructional Materials Lab.
Pub Date n.d.
Note—90 p.
Available from—Vocational Instructional Materials Laboratory, School of Technology, Indiana State University, Terre Haute, Indiana 47809 ($1.00)
MF Available in VT-ERIC Set (ED 037 585)
VT 008 553 (Winter AIM '69)

Curriculum Guide for Trades and Industrial Machine Shop Programs.
Clemson Univ., South Carolina.
Spons Agency—South Carolina State Dept. of Education, Columbia. Trade and Industrial Education Section.
Pub Date 69
Note—72 p.
Available from—Industrial Education Department, Clemson University, Clemson, South Carolina 29631 (Limit: one per State Supervisor of Industrial Education)
MF Available in VT-ERIC Set (See Nov 70 RIE)
VT 009 869 (Spring AIM 70)

Enderby, David R.
Supervised Study Guide, Machine Shop.
Texas Univ., Austin. Dept. of Industrial Education.
Texas Education Agency, Austin. Industrial Education Division.
Pub Date Feb 66
Note—167 p.
MF Available in VT-ERIC Set (ED 017 746)
VT 000 253 (Spring AIM '68)

Erickson, W. A.
Machine Shop. Part 2, Workbook.
California State Dept. of Education, Sacramento. Bur. of Ind. Educ.
Pub Date 67
Note—130 p.
MF Available in VT-ERIC Set (ED 022 971)
VT 005 182 (Fall AIM '68)

A Guide for Use in Developing Training Programs in Machine Shop.
Mississippi State Department of Vocational Education, State College.
Mississippi State Univ., State College. Curriculum Lab.
Pub Date 67
Note—132 p.
MF Available in VT-ERIC Set (ED 020 442)
VT 002 907 (Summer AIM '68)

A Guide for Use in Developing Training Programs in Vocational Welding (Combination).
Mississippi State Department of Vocational Education, State College.
Mississippi State Univ., State College. Curriculum Lab.
Pub Date Feb 67
Note—74 p.
MF Available in VT-ERIC Set (ED 020 442)
VT 003 491 (Summer AIM '68)

Handbook on First Year Apprenticeship Training in Engineering.
Ministry of Labour, London (England).
Pub Date 66
Note—293 p.
Available from—Sales Section, British Information Service, 845 Third Avenue, New York, New York 10022
MF Available in VT-ERIC Set (ED 034 074)
VT 008 651 (Fall AIM '69)

Karnes, James B.
Machine Shop Individual Study, A Course of Study Designed for Students Preparing for or Presently Employed in Machine Shop Occupations.
Missouri Univ., Columbia. Dept. of Industrial Education.
Missouri State Dept. of Education, Jefferson City. Voc. Educ. Div.
Pub Date May 67
Note—125 p.
MF Available in VT-ERIC Set (ED 020 442)
VT 003 743 (Summer AIM '68)

Larson, Milton E.
A Guide for Planning Facilities for Occupational Preparation Programs in the Machine Trades. Interim Report. Research 24.
Ohio State Univ., Columbus. Center for Vocational and Technical Education.
Spons Agency—Office of Education (DHEW), Washington, D. C. Bureau of Research
Bureau No—BR-7-0158
Pub Date Sept 68
Note—74 p.
Grant—OEG-3-7-000158-2037
Available from—The Center for Vocational and Technical Education, The Ohio State University, 1900 Kenny Road, Columbus, Ohio 43210 ($2.00)
ED 023 926
EDRS Price MF–$0.50 HC–$3.80

Leffard, Warren Lee
Employment Opportunities and Training Needs for Technicians in the Metalworking Manufacturing Industries of the Central Ohio Valley With Projections through 1975.
Pub Date 68
Note—195 p.
Available from—University Microfilms, Inc., 300 North Zeeb Road, Ann Arbor, Michigan 48106
ED 026 491
Document Not Available from EDRS.

Machine Shop Group Instruction. Instructor's Guide.
Missouri Univ., Columbia. Dept. of Industrial Education.
Missouri State Dept. of Education, Jefferson City. Industrial Education Section.
Pub Date Sept 67
Note—48 p.
Available from—Industrial Education, 103 Industrial Education Building, University of Missouri, Columbia, Missouri 65201 ($0.50)
MF Available in VT-ERIC Set (ED 034 074)
VT 007 484 (Fall AIM '69)

Machine Trades Jobs and Job Sheets, Series 100.
Ohio State Dept. of Education, Columbus. Trade and Industrial Education Service.
Pub Date Feb 66
Note—138 p.
MF Available in VT-ERIC Set (ED 017 746)
VT 000 699 (Spring AIM '68)

Machine Trades II, Learner's Manual.
Ohio State Dept. of Education, Columbus. Trade and Industrial Education Service.
MTLM-2

Pub Date 65
Note—337 p.
MF Available in VT-ERIC Set (ED 017 746)
VT 000 698 (Spring AIM '68)

McDonough, Frances S.
Guide for Course of Study for Machinist II, Machine Shop, Machine Shop—Machine Operator.
Tennessee State Dept. of Education, Nashville.
Tennessee Vocational Curriculum Laboratory, Murfreesboro.
Pub Date 66
Note—55 p.
MF Available in VT-ERIC Set (ED 017 746)
VT 003 163 (Spring AIM '68)

Numerical Control of Machine Tools, An Instructional Guide.
Cailfornia State Dept. of Education, Sacramento.
Pub Date 67
Note—195 p.
ED 017 663
EDRS Price MF–$0.75 HC–$9.85

Roney, Maurice W., and Others
Machine Tool Operator—General, Entry, Suggested Guide for a Training Course.
Office of Education (DHEW), Washington, D. C.
Pub Date 65
Note—35 p.
ED 013 931
EDRS Price MF–$0.25 HC–$1.85

Suggested Course Outline for Vocational Machine Shop.
New Mexico State Dept. of Vocational Education, Santa Fe. Trade and Industrial Div.
Pub Date n.d.
Note—193 p.
Available from—Trade and Industrial Division, Department of Vocational Education, State Department of Education, 139 South Castillo Street, Santa Fe, New Mexico 87501 (single copies without charge)
MF Available in VT-ERIC Set (ED 030 770)
VT 005 866 (Spring AIM '69)

Technical Report on Occupations in Numerically Controlled Metal-Cutting Machining.
Manpower Administration (DOL), Washington, D. C. U.S. Employment Service.
Pub Date 68
Note—95 p.
Available from—Superintendent of Documents, U.S. Government Printing Office, Washington, D. C. 20402 (L7.2:M56, $0.45)

ED 035 741
EDRS Price MF–$0.50 HC–Not Available from EDRS.

Trade Preparatory Training Planning Guide: Machine Shop.
North Carolina State Dept. of Public Instruction, Raleigh. Trade and Industrial Education.
Pub Date Jul 64
Note—12 p.
MF Available in VT-ERIC Set (ED 030 001)
VT 003 532 (Spring ARM '69)

Training Plan Outlines for Manpower Development and Training Act Courses for Metal Machine Operators.
Office of Education (DHEW), Washington, D. C. Div. of Manpower Development and Training.
Pub Date 65
Note—107 p.
MF Available in VT-ERIC Set (ED 034 074)
VT 009 024 (Fall AIM '69)

Metallurgy

Guide Syllabuses of Training for Metallurgical and Chemical Technicians.
Iron and Steel Industry Training Board, London (England).
Pub Date Oct 66
Note—10 p.
MF Available in VT-ERIC Set (ED 037 585)
VT 008 414 (Winter AIM '69)

Metallurgical Technology. A Suggested 2-Year Post High School Curriculum. Technical Education Program Series No. 10.
Office of Education (DHEW), Washington, D. C. Occupations Section.
OE-81012
Pub Date Nov 68
Note—121 p.
Available from—Superintendent of Documents, U.S. Government Printing Office, Washington, D. C. 20402 (FS5.281:81012, $1.25)
MF Available in VT-ERIC Set (ED 037 585)
VT 008 623 (Winter AIM '69)

Shop Theory for Machine Trades. Metallurgy of Iron and Steel. Sessions 1-12.
Connecticut State Dept. of Education, Hartford. Div. of Vocational Education.
VT-218-T-6.
Pub Date n.d.
Note—51 p.
Available from—Curriculum Center, Bureau of Vocational-Technical Schools, State Department of Education, Room 336, State Office Building, Hartford, Connecticut 06115 (single copies available)
MF Available in VT-ERIC Set (ED 037 585)
VT 008 291 (Winter AIM '69)

Sheet Metal

Gilsdorf, John R., and Others
The Mechanical Design Technology Course in the Madison Vocational, Technical, and Adult Schools, Madison, Wisconsin, 1965.
Madison Vocational, Technical, and Adult Schools, Wis.
Pub Date 65
Note—178 p.
MF Available in VT-ERIC Set (ED 022 971)
VT 005 459 (Fall AIM '68)

Karnes, James B.
Sheet-Metal, A Course of Study Designed for Cooperative Part-Time Students Employed in Sheet Metal Occupations.
Missouri Univ., Columbia. Dept. of Industrial Education.
Missouri State Dept. of Educ., Jefferson City. Ind. Educ. Sect.
Pub Date Jan 67
Note—142 p.
MF Available in VT-ERIC Set (ED 020 442)
VT 002 077 (Summer AIM '68)

Leffard, Warren Lee
Employment Opportunities and Training Needs for Technicians in the Metalworking Manufacturing Industries of the Central Ohio Valley with Projections through 1975.
Pub Date 68
Note—195 p.
Available from—University Microfilms, Inc., 300 North Zeeb Road, Ann Arbor, Michigan 48106
ED 026 491
Document Not Available from EDRS.

Liewer, Urban J., and Others
Light Metals 5-6, Occupational. Industrial Education Course Outline.
Pub Date 68
Note—22 p.
Available from—Long Beach Unified School District, Calif. Office of Curriculum and Instruction
MF Available in VT-ERIC Set (See Nov 70 RIE)
VT 009 710 (Spring AIM '70)

Lindsay, W. C.
Supervised Study Guide in Sheet Metal.
Texas Univ., Austin. Dept. of Industrial Education.
Texas Education Agency, Austin. Industrial Educ. Div.
Pub Date Mar 66
Note—109 p.
MF Available in VT-ERIC Set (ED 017 746)
VT 000 789 (Spring AIM '68)

Roney, Maurice
Sheet Metal Worker, A Suggested Training Course.
Office of Educ., Washington, D. C. Div. of Vocational and Technical Education.
Oklahoma State Univ., Stillwater.
Pub Date 65
Note—24 p.
ED 012 336
EDRS Price MF–$0.25 HC–$1.30

Sheet Metal, A Study Guide and Progression Record for Sheet Metal Students in a Cooperative Training Program. (File, No. 324).
Alabama Univ. Dept. of Trade and Ind. Educ.
Pub Date Nov 65
Note—68 p.
MF Available in VT-ERIC Set (ED 015 349)
VT 003 119 (Winter AIM '67)

Training Plan Outlines for Manpower Development and Training Act Courses for Sheet Metal Workers and Sheet Metal Worker Helpers.
Office of Education (DHEW), Washington, D. C. Div. of Manpower Development and Training.
Pub Date 65
Note—34 p.
MF Available in VT-ERIC Set (ED 034 074)
VT 009 034 (Fall AIM '69)

Tool and Die

A Basic Plan for the Organization and Management of Instruction in Vocational Tool and Die.
Mississippi State Dept. of Vocational Education, State College.
Mississippi State Univ., State College. Curriculum Lab.
Pub Date 67
Note—68 p.
MF Available in VT-ERIC Set (ED 022 971)
VT 003 993 (Fall AIM '68)

Theory and Fundamental Process Units, Tool and Diemaking. Grade 11.
Connecticut State Dept. of Education, Hartford. Div. of Vocational Education.
Pub Date 66
Note—104 p.
Available from—Curriculum Center, Bureau of Vocational-Technical Schools, State Dept. of Education, Room 336, State Office Building, Hartford, Connecticut 06115 (single copies available)
MF Available in VT-ERIC Set (ED 037 585)
VT 008 290 (Winter AIM '69)

Arc Welding. Materials and Material Processes Series.
Materials and Mechanics Research Center (Army), Watertown, Mass. Quality and Reliability Assurance Handbook.
Battelle Memorial Inst., Columbus, Ohio. Columbus Labs.
Pub Date 1 Jul 68
Note—358 p.
MF Available in VT-ERIC Set (ED 037 585)
VT 008 983 (Winter AIM '69)

Cockrum, Jim
Supervised Study Guide in Welding.
Texas Univ., Austin. Dept. of Industrial Education.
Texas Education Agency, Austin. Industrial Education Div.
Pub Date Nov 67
Note—131 p.
MF Available in VT-ERIC Set (ED 022 971)
VT 004 945 (Fall AIM '68)

Dixon, Emory H.
Recommendations for Teaching Welding; Setting Up Training Programs and Shops.
Hobart Brothers Technical School, Troy, Ohio.
Pub Date 67
Note—77 p.
Available from—Hobart Brothers Company, Hobart Square, Troy, Ohio 45373 ($1.50)
MF Available in VT-ERIC Set (See Nov 70 RIE)
VT 007 144 (Spring AIM '69)

Gas Metal-Arc Welding (MIG). Welding School Workbook.
Hobart Welding School, Troy, Ohio.
Pub Date 68
Note—39 p.
Available from—Hobart Brothers Company, Hobart Square, Troy, Ohio 45373 ($1.50)
MF Available in VT-ERIC Set (ED 032 434)
VT 007 583 (Summer AIM '69)

Liewer, Urban J., and Others
Heavy Metals 5-6, Occupational. Industrial Education Course Outline.
Long Beach Unified School District, Calif. Office of Curriculum and Instruction.
Pub Date 68
Note—25 p.
MF Available in VT-ERIC Set (See Nov 70 RIE)
VT 009 709 (Spring AIM '70)

McDonough, Frances S.
Guide for Course of Study for Welder Combination.
Tennessee State Board of Vocational Education, Murfreesboro. Manpower Development Training Section.
Pub Date Apr 66
Note—61 p.
Available from—Vocational Curriculum Laboratory, Box 1114, Murfreesboro, Tennessee 37130 ($2.00)
MF Available in VT-ERIC Set (ED 037 585)
VT 008 136 (Winter AIM '69)

Morgan, Daryle Whitney
Status and Pre-Employment Training Requirements of Welding Tradesmen, Technicians, and Technologists.
Pub Date 68
Note—137 p.
Available from—University Microfilms, Inc., 300 North Zeeb Road, Ann Arbor, Michigan 28106
ED 026 492
Document Not Available from EDRS.

Oxy-Acetylene Welding, Technical Information.
Indiana State Dept. of Public Instruction, Indianapolis. Trade and Industrial Service.
Indiana State Coll., Terre Haute. Instructional Materials Lab.
Pub Date n.d.
Note—40 p.
Available from—Vocational Instructional Materials Laboratory, School of Technology, Indiana State University, Terre Haute, Indiana 47809 ($0.40)
MF Available in VT-ERIC Set (ED 037 585)
VT 008 626 (Winter AIM '69)

Recommendations for the Training of Boilermaker, Welder and Blacksmith Apprentices, 1967.
Iron and Steel Industry Training Board, London (England).
Pub Date May 67
Note—36 p.
MF Available in VT-ERIC Set (ED 037 585)
VT 008 841 (Winter AIM '69)

Sergeant, Harold A.
Electric Arc Welding; Instructor's Guide.
Washington State Univ., Pullman. Dept. of Education.
Office of Education (DHEW), Washington, D. C.
Pub Date n.d.
Note—12 p.
MF Available in VT-ERIC Set (See Nov 70 RIE)
VT 006 992 (Spring AIM '70)

Sergeant, Harold A.
Oxy-Acetylene Welding Series; Instruction Book 1.
Washington State Univ., Pullman. Dept. of Education.
Office of Education (DHEW), Washington, D. C.
Pub Date 68
Note—133 p.
MF Available in VT-ERIC Set (ED 030 770)
VT 007 002 (Spring AIM '69)

Sergeant, Harold A.
Oxy-Acetylene Welding Series; Instruction Book 2.
Washington State Univ., Pullman. Dept. of Education.
Office of Education (DHEW), Washington, D. C.
Pub Date 68
Note—123 p.
MF Available in VT-ERIC Set (ED 030 770)
VT 007 001 (Spring AIM '69)

Training in Shielded Metal-Arc Pipe Welding (Uphill). A Step by Step Explanation of How to Weld Pipe in the Horizontal (fg) and Vertical (2g) Fixed Positions with Sufficient Skill to pass the ASME Procedure Qualifications Test.
Hobart Brothers Welding School, Troy, Ohio.
EW-269:PWU
Pub Date 68
Note—36 p.
Available from—Hobart Brothers Company, Hobart Square, Troy, Ohio 45373 ($1.50)
MF Available in VT-ERIC Set (ED 034 074)
VT 007 584 (Fall AIM '69)

Training Plan Outlines for Manpower Development and Training Act Courses for Inert Gas, Heliarc, Arc, and Combination Welders.
Office of Education (DHEW), Washington, D.C. Div. of Manpower Development and Training.
Pub Date 65
Note—75 p.
MF Available in VT-ERIC Set (ED 034 074)
VT 009 305 (Fall AIM '69)

Using the Carbon-Arc Torch.
Illinois Univ., Urbana. Vocational Agriculture Service.
Pub Date 68
Note—13 p.
Available from—Vocational Agriculture Service, 434 Mumford Hall, University of Illinois, Urbana, Illinois 61801 ($0.15)
MF Available in VT-ERIC Set (ED 030 770)
VT 007 648 (Spring AIM '69)

Welding.
West Virginia State Board of Education, Charleston. Bureau of Vocational, Technical and Adult Education.

Pub Date Apr 67
Note—55 p.
Available from—Vocational Industrial Curriculum Department, Capitol Building, Charleston, West Virginia 25305 ($1.25)
MF Available in VT-ERIC Set (ED 034 074)
VT 001 284 (Fall AIM '69)

Welding, A Study Guide and Progression Record for Welding Students in a Cooperative Training Program. (File, No. 467-R).
Alabama Univ. Dept. of Trade and Ind. Educ.
Pub Date Sept 66
Note—98 p.
MF Available in VT-ERIC Set (ED 015 349)
VT 001 671 (Winter AIM '67)

Welding; Suggested Basic Course Outline.
Texas A and M Univ., College Station. Engineering Extension Service.
Texas Education Agency, Austin.
Pub Date n.d.
Note—58 p.
Available from—Instructional Materials Production, Engineering Extension Service, Texas A and M University, F. E. Drawer K., College Station, Texas 77843 ($1.25)
MF Available in VT-ERIC Set (See Nov 70 RIE)
VT 009 926 (Spring AIM '70)

Welding. Suggested Course Outline.
Ohio State Dept. of Education, Columbus. Trade and Industrial Education.
Pub Date Jan 69
Note—68 p.
Available from—Ohio Trade and Industrial Education Service, Instructional Materials Laboratory, The Ohio State University, 1885 Neil Avenue, Columbus, Ohio 43210 ($1.00)
MF Available in VT-ERIC Set (ED 032 434)
VT 007 987 (Summer AIM '69)

Welding, Unit I—Oxyacetylene Cutting, Unit II—Oxyacetylene Welding, Job Sheets.
Louisiana Vocational Curriculum Development and Research Center.
Pub Date 67
Note—88 p.
MF Available in VT-ERIC Set (ED 017 746)
VT 003 154 (Spring AIM '68)

Welding, Unit III—Arc Welding, Job Sheets.
Louisiana Vocational Curriculum Development and Research Center.
Pub Date 67
Note—148 p.
MF Available in VT-ERIC Set (ED 017 746)
VT 003 155 (Spring AIM '68)